![muRata INNOVATOR IN ELECTRONICS]

<table>
<tr><td></td><td>Murata Wi-Fi/BT
EVK for i.MX6</td></tr>
</table>

<table>
<tr><td>Quick Start Guide
(Linux)</td></tr>
</table>

Revision History

Revision	Date	Author	Change Description
1.0	Sept 1, 2015	S Kerr, G Mohiuddin	Initial Release
1.1	Sept 6, 2015	S Kerr	Removed software compile/build dependency. User can bring up Freescale platform by downloading necessary files before flashing bootable SD card. Refer to Linux User Guide on software build procedures.
2.0	Nov 7, 2015	S Kerr	Modified Murata Wi-Fi/BT EVK definition. This simplifies bring-up on Freescale i.MX6 Platforms. Incorporated changes for i.MX6UL 3.14.38 GA BSP Release.

This page intentionally left blank.

Table of Contents

LIST OF TABLES

LIST OF FIGURES

1 Introduction

Murata has partnered with Freescale Semiconductor and Broadcom Corporation to offer a complete Wi-Fi and Bluetooth connectivity environment for building world class Internet-connected products. The Murata Connectivity Modules enable developers to minimize the development time and effort for connectivity function implementation. This guide provides details for getting started with Wi-Fi and Bluetooth on iMX6 platforms using Freescale Linux 3.14.38_6UL GA BSP. A typical Murata Wi-Fi/BT EVK contains all the hardware necessary to enable Wi-Fi and Bluetooth functionality: contents are listed in **Table 1**.

Part #/ Tag Color	Picture of Contents	Description of Contents
1. (red)		Murata Wi-Fi/BT EVB such as Type ZP, Type 1BW, Type 1DX and SN8000. Type ZP is pictured. See **Table 2**.
2. (green)		**Murata i.MX InterConnect V1:** SD pins (DAT0..7) provide both Wi-Fi SDIO and Bluetooth UART connection. Wired SD Card Extender connects control signals: WL_REG_ON BT_REG_ON WL_HOST_WAKE (optional)
3. (blue)		**Murata i.MX InterConnect V2:** SD pins provide Wi-Fi SDIO; ribbon cable connection provides Bluetooth UART and control signals. 50 mm ribbon cable included.
4. (yellow)		2.4/5.0 GHz Whip/Tilt SMA Antenna (for dual-band Wi-Fi) Or 2.4 GHz Whip SMA Antenna (for single band Wi-Fi)
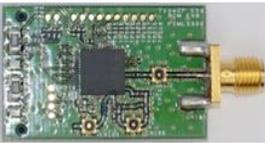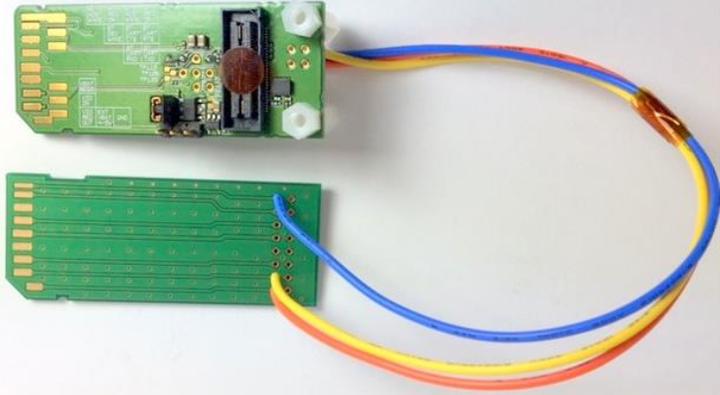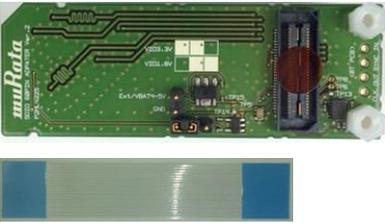
Table 1: Murata Wi-Fi/BT EVK (for i.MX6) Contents

Murata Wi-Fi/BT EVK's supported on Freescale i.MX6 Platforms are listed in **Table 2**. Currently four modules are available. If you are having difficulty obtaining the desired Murata EVK, please contact Murata for additional support.

Part	Description	Order part number	Wi-Fi	Bluetooth Smart Ready
Type ZP EVK+	802.11b/g/n/ac and BT EVK for i.MX6	LBEH5HMZPC-TEMP-DS-SD	b/g/n/ac	Yes
Type 1BW EVK+	802.11a/b/g/n and BT EVK for i.MX6	LBEH5DU1BW-TEMP-DS-SD	a/b/g/n	Yes
Type 1DX EVK+	802.11b/g/n and BT EVK for i.MX6	LBEE5KL1DX-TEMP-DS-SD	b/g/n	Yes
SN8000	802.11b/g/n EVK for i.MX6 FCC certified, industrial	88-00153-90	b/g/n	No

Table 2: Murata Wi-Fi/BT EVK's Supported

Connection Diagram for the Murata Interconnect kit is provided in **Figure 1**. Murata Wi-Fi/BT kit for i.MX6 enables this configuration by providing two custom-built Adapter boards. Two adapter boards are provided in each kit to allowing the user to bring up the Wi-Fi/Bluetooth interfaces in the easiest manner possible.
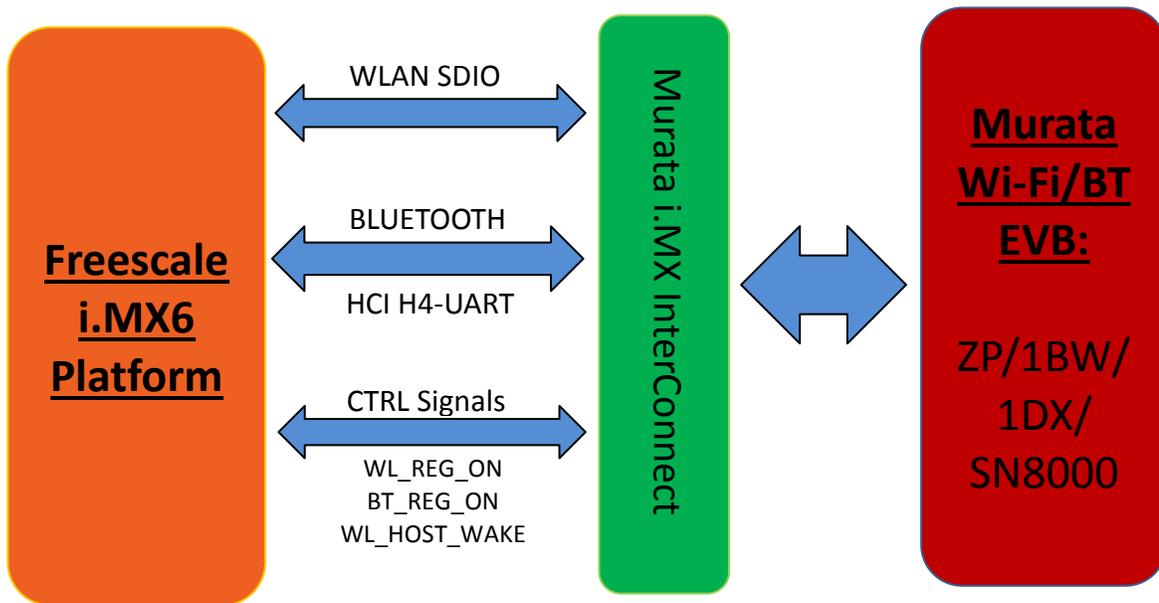
Figure 1: Murata IMX Interconnect Kit Interfaces

Note: 3rd party Freescale i.MX6 EVK's are *not* supported.

Table 3 presents the Freescale Platform and Murata Wi-Fi/BT EVK configurations. The first column displays the default i.MX InterConnect Adapter (V1 or V2) for each combination of Freescale branded i.MX6 Reference Platforms and Murata Wi-Fi/BT EVK. An additional column indicates the optional configuration.

>   NOTE: Murata recommends the default configuration.

As **Table 3** indicates, currently four (4) Freescale i.MX6 Platforms are supported. There is only one complication for default configuration. Namely the i.MX 6Quad/DualLite SABRE-SD requires rework to successfully interface with the Murata hardware. As shipped from the factory, the i.MX 6Quad/DualLite SABRE-SD does not connect the J13 Bluetooth ribbon cable connector to the necessary UART and control signals. Please reference the Hardware User Manual for necessary rework. If Wi-Fi only functionality is acceptable then V1 Adapter is well suited (see optional column).

The only other optional hardware configuration is for i.MX 6SoloX SABRE-SD. The V1 adapter requires no rework for this platform and is the default configuration. However if the V2 adapter is desired (frees up one SD2 card slot) then rework is necessary. For specifics please reference the Hardware User Manual.

Only one of the four i.MX6 Platforms do not connect all control signals: WL_REG_ON, BT_REG_ON, and WL_HOST_WAKE. The i.MX6 UltraLite EVK does not connect WL_HOST_WAKE by default.

Freescale i.MX6 Platform	DEFAULT	OPTIONAL	Notes
i.MX6Quad/DualLite SABRE-SD	**V2** (Rework Required)	**V1** (Wi-Fi Only)	**Please reference section 3.3.2.1 of Hardware User Manual for rework instructions. V1 adapter option requires different DTB file.**
i.MX 6SoloX SABRE-SD	**V1**	**V2** (Rework Required)	**For V2 adapter option, please reference section 3.1.2.1 of Hardware User Manual for rework instructions. V2 adapter requires different DTB file.**
i.MX 6SoloLite EVK	**V1**	**N/A**	
i.MX 6UltraLite EVK	**V2**	**N/A**	**Rework necessary to UltraLite platform is option WL_HOST_WAKE is required. Please reference section 3.4.1.1 of Hardware User Manual for rework instructions.**

Table 3: Murata i.MX InterConnect Adapter Selection Table

⇨ For any given Freescale Platform/Murata EVK, click on the corresponding "V1" or "V2" hyperlink to get redirected to relevant section in document.

1.1 Acronyms

Acronym	Meaning
API	Application Programming Interface
DTB	Device Tree Blob: Kernel reads in at boot time for configuration.
EVB	Evaluation Board (Murata module on custom PCB)
EVK	Evaluation Kit (includes EVB + Adapter)
FW	Firmware
GPIO	General Purpose Input/Output
PC	Personal Computer
SW	Software
UART	Universal Asynchronous Receiver/Transmitter
USB	Universal Serial Bus

Table 4: Acronyms used in Quick Start Guide

1.2 References

1.2.1 Linux User Manual

Murata Wi-Fi/BT EVK for i.MX6 Linux User Manual 2.0, "Murata Wi-Fi BT EVK for i.MX6 Linux User Manual 2.0.pdf".

This manual describes all steps necessary to build the file system, kernel, DTB files, and WLAN "bcmdhd" driver necessary for supporting Freescale i.MX6 Platforms and the Murata Wi-Fi/BT EVK.

1.2.2 Hardware User Manual

Murata Wi-Fi/BT EVK for i.MX6 Hardware User Manual 2.0, "Murata Wi-Fi BT EVK for i.MX6 Hardware User Manual 2.0.pdf".

This manual details the Murata Wi-Fi/BT EVK InterConnect Adapter hardware. All interface signals to the Freescale i.MX6 Platforms are described. Specifics on interfacing each i.MX6 Platform to Murata Wi-Fi/BT EVK are provided.

2   Connecting to i.MX 6SoloX SABRE-SD

Referring to **Table 3**, the V1 Adapter is the default solution for this platform. No rework is required, Murata Wi-Fi/BT EVB is oriented right-side up, and it provides both Wi-Fi and BT functionality via SD3/SD2 slots: see **Figure 2** below.

2.1   Murata i.MX InterConnect V1 Adapter

[1] Make sure no power is applied to i.MX 6SoloX SABRE-SD.
[2] Check that VIO setting on Murata i.MX6 Interconnect V1 Adapter (Part #2 in **Table 1**) is set to 3.3V (VBAT_SDIO). Refer to Red Rectangle for correct jumper setting in **Figure 8**.
[3] Insert V1 Adapter board into SD3 slot and SD Card Extender into SD2 slot. Note the orientation as shown in **Figure 2**.
[4] Connect antenna (Part #4) to the SMA connector of the Murata EVB (Part #1).
[5] Now you can connect the EVB to the 60-pin Samtec connector on the V1 Adapter board.
[6] Prepare SD card to boot platform per Section **6**. U-boot has to be specific for i.MX 6SoloX.
[7] Power on platform and interrupt at u-boot. <u>Type in following commands to set correct DTB file:</u>
      => setenv fdt_file imx6sx-sdb-murata-v1_sdext.dtb
      => saveenv
      => reset   (causes platform to boot kernel)
[8] Refer to Section **7** to test/verify Wi-Fi and Bluetooth functionality.
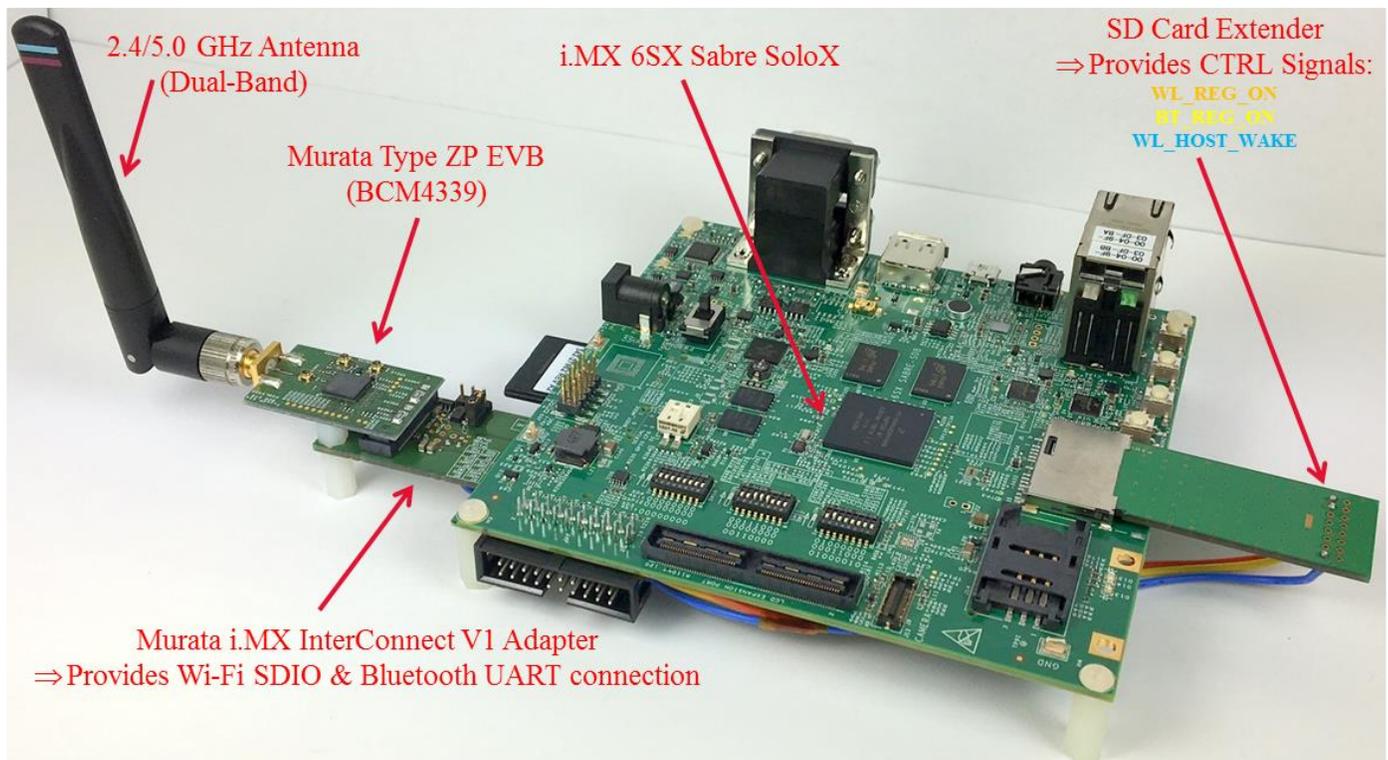
Figure 2: i.MX 6SoloX SABRE-SD with V1 Adapter and Type ZP EVB

2.2 Murata i.MX InterConnect V2 Adapter (Optional)

Refer to the [Hardware User Manual](#) for detailed necessary rework instructions on i.MX 6SoloX SABRE-SD. Both WL_REG_ON and WL_HOST_WAKE need to be connected. Clearly two advantages with this configuration: "tidy" solution and opens up SD3 slot: see **Figure 3** below.

⇨ These steps **will only pass** if Freescale Platform has been correctly reworked.

[1] Make sure no power is applied to i.MX 6SoloX SABRE-SD.
[2] Check that VIO setting on Murata i.MX6 Interconnect V2 Adapter (Part #3 in **Table 1**) is set to 3.3V (VBAT_SDIO). Refer to Red Rectangle for correct jumper setting in **Figure 11**.
[3] After connecting ribbon cable to both adapter and i.MX 6SoloX, insert V2 Adapter board into SD2 slot. Refer to the [Hardware User Manual](#) for more information on ribbon cable connection.
[4] Connect antenna (Part #4) to the SMA connector of the Murata EVB (Part #1).
[5] Now you can connect the EVB to the 60-pin Samtec connector on the V2 Adapter board.
[6] Prepare SD card to boot platform per Section **6**. U-boot has to be specific for i.MX 6SoloX.
[7] Power on platform and interrupt at u-boot. Type in following commands to set correct DTB file:
    => setenv fdt_file imx6sx-sdb-murata-v2.dtb
    => saveenv
    => reset (causes platform to boot kernel)
[8] Refer to Section **7** to test/verify Wi-Fi and Bluetooth functionality.
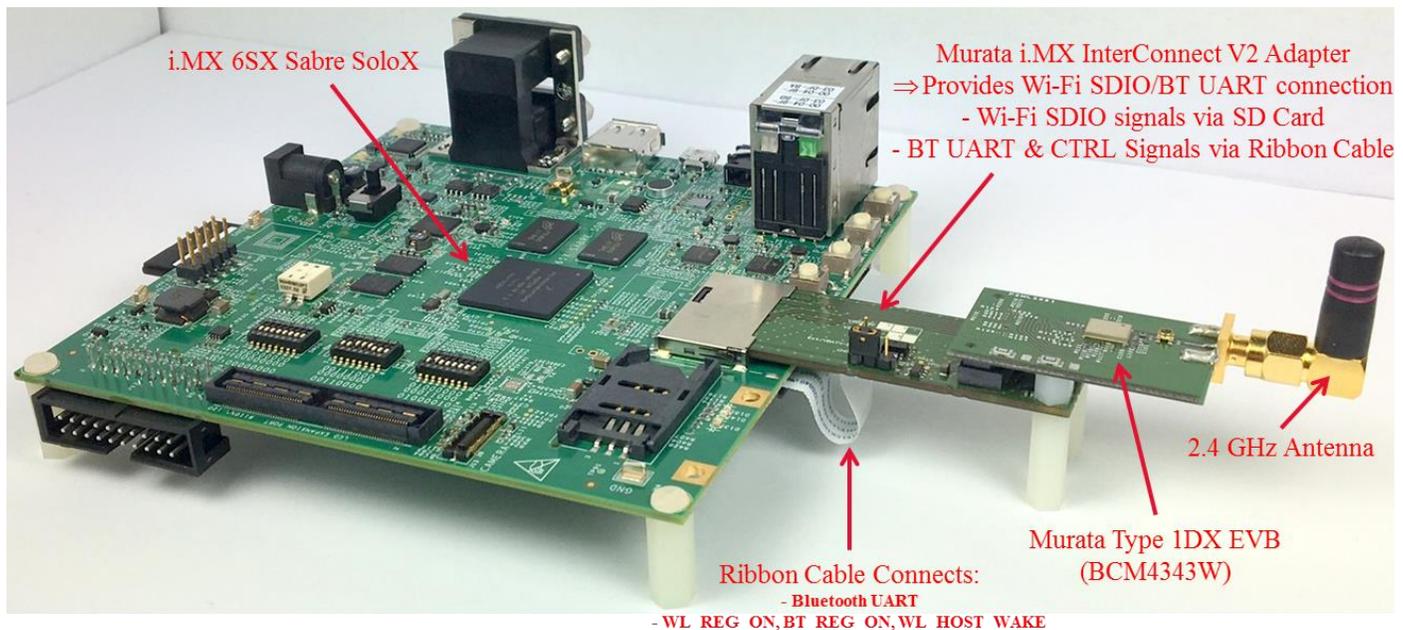
Figure 3: i.MX 6SoloX SABRE-SD with V2 Adapter and Type 1DX EVB

3 Connecting to i.MX 6SoloLite EVK

Referring to **Table 3**, V1 Adapter is the only solution for this platform. Murata Wi-Fi/BT EVB is oriented right-side up, and it provides both Wi-Fi and BT functionality via SD1 slot with control signals connected from SD3 slot using SD Card Extender: see **Figure 4** below.

3.1 Murata i.MX InterConnect V1 Adapter

[1] Make sure no power is applied to i.MX 6SoloLite EVK.

[2] Check that VIO setting on Murata i.MX6 Interconnect V1 Adapter (Part #2 in **Table 1**) is set to 3.3V (VBAT_SDIO). Refer to Red Rectangle for correct jumper setting in **Figure 8**.

[3] Insert V1 Adapter board into SD1 slot and SD Card Extender into SD3 slot. Note the orientation as shown in **Figure 4**.

[4] Connect antenna (Part #4) to the SMA connector of the Murata EVB (Part #1).

[5] Now you can connect the EVB to the 60-pin Samtec connector on the V1 Adapter board.

[6] Prepare SD card to boot platform per Section 6. U-boot has to be specific for i.MX 6SoloLite.

[7] Power on platform and interrupt at u-boot. Type in following commands to set correct DTB file:

```
=> setenv fdt_file imx6sl-evk-murata-v1_sdext.dtb
=> saveenv
=> reset  (causes platform to boot kernel)
```

[8] Refer to Section **7** to test/verify Wi-Fi and Bluetooth functionality.
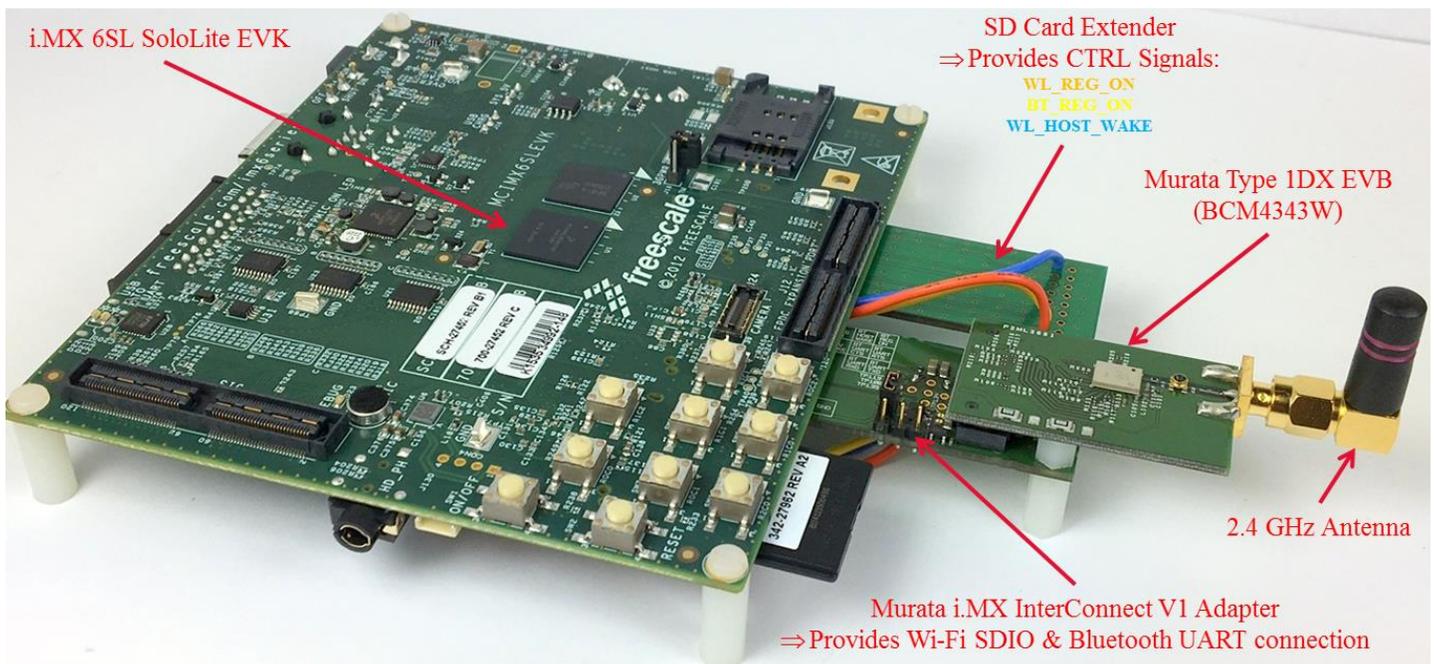
Figure 4: i.MX 6SoloLite EVK with V1 Adapter and Type 1DX EVB

4 Connecting to i.MX 6Quad/DualLite SABRE-SD

Referring to **Table 3**, the i.MX 6Quad/DualLite SABRE-SD presents additional challenges. If the only interface required is WLAN, then the V1 Adapter on SD2 slot (with SD Card Extender on SD3 slot) provides an adequate solution. However if Bluetooth (UART) connection is required, then the only option is to rework the Freescale platform.

As shipped from the factory, the i.MX 6Quad/DualLite SABRE-SD does not connect the J13 Bluetooth ribbon cable connector to the necessary UART and control signals. Please reference the Hardware User Manual for necessary rework. Freescale also details the board rework in their schematic file (Bluetooth page). Page 15 of the Freescale schematic (SPF-27516_C3.pdf) correctly captures the necessary rework to be done.

Repeated here:

> **NOTE**: To use J13, populate resistors R209 - R213 and depopulated the SPI NOR FLASH U14. Resistors R214 and R215 should not be populated because both UART outputs (TXDs) have been crossed together and both UART inputs (RXDs) have been crossed together. To make the UART work correctly, solder a jumper wire from R215 pad 1 to R214 pad 2 and from R215 pad 2 to R214 pad 1.

⇨ If (after rework) V2 Adapter does not look to work correctly, try V1 Adapter and verify just Wi-Fi functionality. Board rework can only be done by a skilled technician with the correct tools.

4.1 Murata i.MX InterConnect V2 Adapter

⇨ These steps **will only pass** if Freescale Platform has been correctly reworked. See Section **4**.

NOTE: The Freescale i.MX6 platform has been inverted. This makes working with Wi-Fi/BT EVK much easier. The one drawback is if Ethernet port must be accessed. To properly match Wi-Fi/BT EVK and i.MX6 platform heights, nylon washers are added as additional spacers to "standard" Freescale i.MX6 standoffs.

[1] Make sure no power is applied to i.MX 6Quad/DualLite SABRE-SD.
[2] Check that VIO setting on Murata i.MX6 Interconnect V2 Adapter (Part #3 in **Table 1**) is set to 3.3V (VBAT_SDIO). Refer to Red Rectangle for correct jumper setting in **Figure 11**.
[3] After connecting ribbon cable to both adapter and i.MX6Q/DL, insert Adapter board into SD2 slot. Note the orientation as shown in **Figure 5**.
[4] Connect antenna (Part #4) to the SMA connector of the Murata EVB (Part #1).
[5] Now you can connect the EVB to the 60-pin Samtec connector on the Adapter board.
[6] Prepare SD card to boot platform per Section **6**. U-boot has to be specific for i.MX 6Quad/DL.
[7] Power on platform and interrupt at u-boot. Type in following commands to set correct DTB file:
  => setenv fdt_file imx6q-sabresd-murata-v2.dtb (or imx6dl-sabresd-murata-v2.dtb)
  => saveenv
  => reset (causes platform to boot kernel)
[9] Refer to Section **7** to test/verify Wi-Fi and Bluetooth functionality.
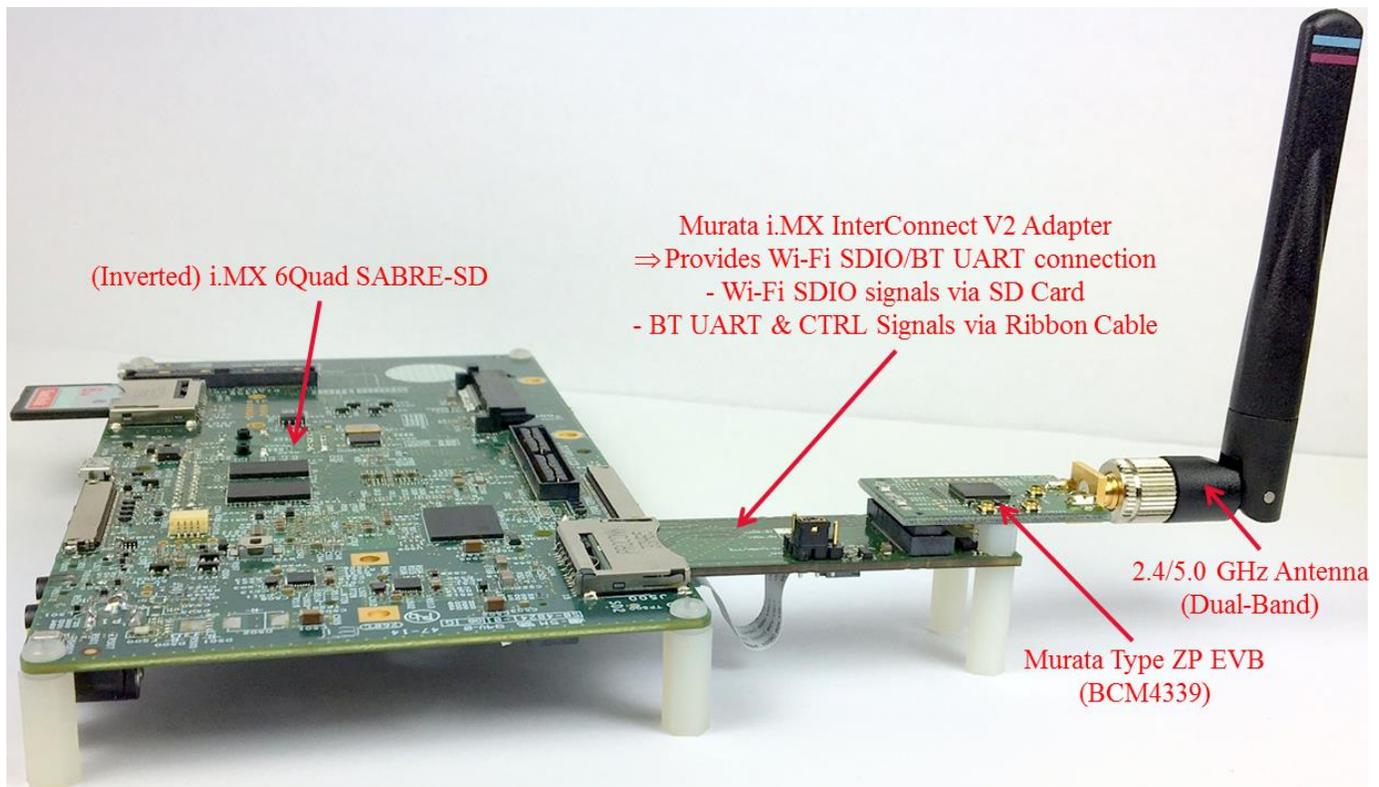
Figure 5: i.MX 6Quad SABRE-SD (Inverted) with V2 Adapter and Type ZP EVB

4.2 Murata i.MX InterConnect V1 Adapter (Optional)

⇨ This configuration only supports Wi-Fi functionality.

NOTE: This Wi-Fi/BT configuration does not allow the user to use SD3 slot to default SD Card boot slot. To boot platform, the user must configure alternative boot method such as EMMC flash.

[1] Make sure no power is applied to i.MX 6Quad/DualLite SABRE-SD.
[2] Check that VIO setting on Murata i.MX6 Interconnect V1 Adapter (Part #2 in **Table 1**) is set to 3.3V (VBAT_SDIO). Refer to Red Rectangle for correct jumper setting in **Figure 8**.
[3] Insert V1 Adapter board into SD2 slot and SD Card Extender into SD3 slot. Note the orientation as shown in **Figure 6**.
[4] Connect antenna (Part #4) to the SMA connector of the Murata EVB (Part #1).
[5] Now you can connect the EVB to the 60-pin Samtec connector on the Adapter board.
[6] Prepare SD card to boot platform per Section **6**. U-boot has to be specific for i.MX 6Quad/DL.
[7] Power on platform and interrupt at u-boot. <u>Type in following commands to set correct DTB file:</u>
      => setenv fdt_file imx6q-sabresd-murata-v1_sdext.dtb (or imx6dl-sabresd-murata-v1_sdext.dtb)
      => saveenv
      => reset (causes platform to boot kernel)
[8] Refer to Section **7** to test/verify Wi-Fi and Bluetooth functionality.
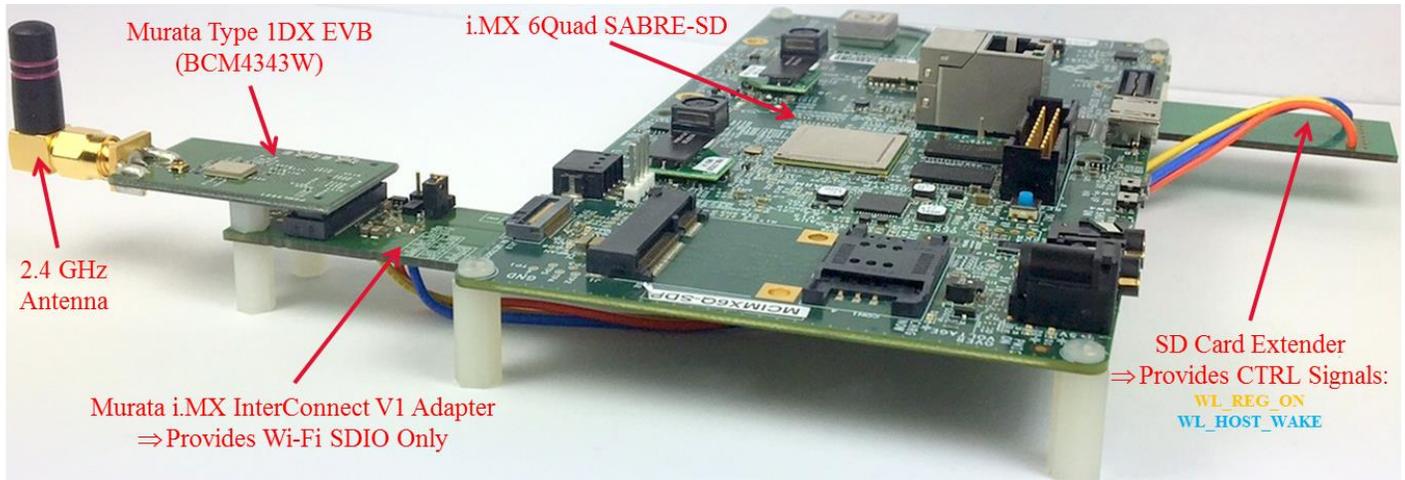
Figure 6: i.MX 6Quad SABRE-SD with V1 Adapter and Type 1DX EVB

5   Connecting to i.MX 6UltraLite EVK

Referring to **Table 3**, V2 adapter is the only solution for i.MX 6UltraLite EVK. No rework is required for V2 Adapter for providing both Wi-Fi (SDIO in-band interrupt signaling) and Bluetooth connectivity.

> NOTE: The default hardware configuration on i.MX 6UltraLite EVK only supports SDIO in-band interrupts. For out-of-band interrupts (WL_HOST_WAKE connected), rework is necessary. For specifics please reference the **Hardware User Manual**.

5.1   Murata i.MX InterConnect V2 Adapter

[1] Make sure no power is applied to i.MX 6UltraLite EVK.

[2] Check that VIO setting on Murata i.MX6 Interconnect V2 Adapter (Part #3 in **Table 1**) is set to 3.3V (VBAT_SDIO). Refer to Red Rectangle for correct jumper setting in **Figure 11**.

[3] Connect antenna (Part #4) to the SMA connector of the Murata EVB (Part #1).

[4] Connect the EVB to the 60-pin Samtec connector on the Adapter board.

[5] Connect ribbon cable at both ends before inserting Murata EVK into SD1 slot. Note the orientation as shown in **Figure 7**. The UltraLite uses a "push-push" SD card connector. Make sure that the adapter clicks in correctly.

[6] Prepare SD card to boot platform per Section **6**. U-boot has to be specific for i.MX 6UltraLite.

[7] Power on platform and interrupt at u-boot. Type in following commands to set correct DTB file:

```
=> setenv fdt_file imx6ul-14x14-evk-murata-v2.dtb
=> saveenv
=> reset  (causes platform to boot kernel)
```

[8] Refer to Section **7** to test/verify Wi-Fi and Bluetooth functionality.
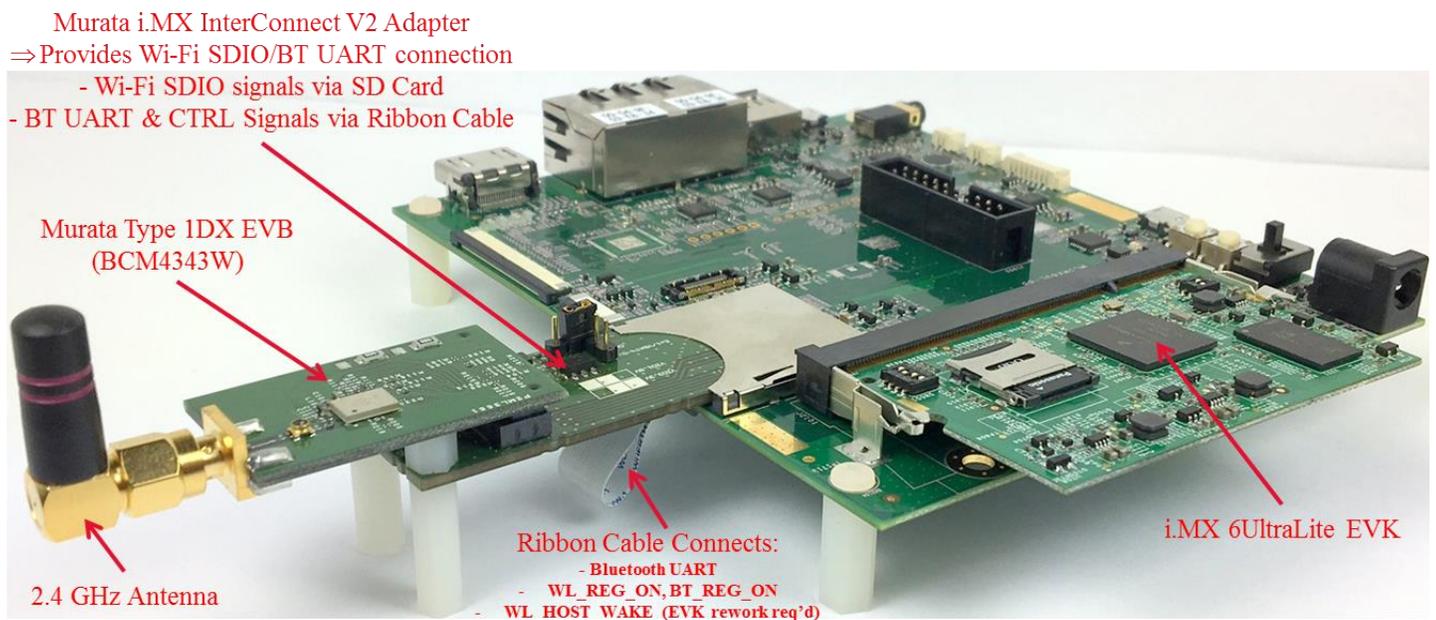
Figure 7: i.MX 6UltraLite EVK with V2 Adapter and Type 1DX EVB

6 Preparing Bootable SD Card for i.MX6 with Murata Wi-Fi/BT EVK

The current release supported is Freescale Linux 3.14.38_6UL GA BSP. The L3.14.38_6UL release integrates the necessary Broadcom Wi-Fi and Bluetooth drivers. For this specific release, Freescale only provides a pre-built image for the i.MX 6UltraLite EVK. For other Freescale i.MX6 Platforms the end user must build the image using the Yocto distribution for L3.14.38. If you prefer to use L3.14.38 rootfs (ideal approach) then please reference the Linux User Manual.

However to ease initial platform bring-up, a hybrid approach is taken (for non-UltraLite platforms) by using previous L3.14.28_GA rootfs with the new L3.14.38 Kernel, DTB, and Wi-Fi driver files:
- Download the appropriate i.MX6 "bundle": hyperlinks provided in **Table 5**.
- Flash SD card with "*.sdcard" image file.
- Download modified kernel file (zImage), new Murata Device Tree Blob (DTB) files, and Wi-Fi driver (bcmdhd.ko) from Murata/i.MX Portal on Freescale Community website.
- For non-UltraLite platforms, copy zImage and dtb files to "/boot" folder. Also copy "bcmdhd.ko" to "/lib/modules/3.14.xx.yy/kernel/drivers/net/wireless/bcmdhd/" folder.
- For i.MX 6UltraLite, copy only necessary dtb file to "/boot" folder.
- Download Broadcom Firmware package from Freescale/Murata i.MX Support Portal on Broadcom Community website and copy to "/home/root" folder
- "Blacklist" the bcmdhd driver so there is no attempt to insmod it during kernel boot. This is accomplished by editing the "/etc/modprobe.d/blacklist.conf" file.

6.1 IMPORTANT: Getting Signed Up for Freescale and Broadcom Portals

This is the only step which is time-sensitive. You need to be a registered user at both Freescale and Broadcom Community websites. Once you are registered please email imxfaq@murata.com to gain access to both Freescale/Murata i.MX Support Portal and Murata/i.MX Portal. Turnaround for this request is typically no more than 24 hours.

6.2 Downloading Freescale and Broadcom Packages

Once you have access, download the following packages:
- L3.14.38_6ul-ga_binaries_11072015
- BRCM_FW_for_i.MX_11072015

6.3 Downloading i.MX6 Image Files to Flash SD Card

Table 5 provides direct download links to i.MX6 "Bundles" for each Freescale Platform. The available SD card images are included too. All links point to common www.freescale.com download area. Simply click on the hyperlink for the desired "SD Card Image File" and download the package. Once the download has finished pull the appropriate *.sdcard file from the bundle/package.

i.MX6 Platform	Available SD Card Image Files
i.MX 6Quad/DualLite SABRE-SD	fsl-image-gui-x11-imx6qdlsolo.sdcard
	fsl-image-qt5-x11-imx6qdlsolo.sdcard
i.MX 6SoloX SABRE-SD	fsl-image-gui-x11-imx6sxsabresd.sdcard
	fsl-image-qt5-x11-imx6sxsabresd.sdcard
i.MX 6SoloLite EVK	fsl-image-gui-x11-imx6slevk.sdcard
	fsl-image-qt5-x11-imx6slevk.sdcard
i.MX 6UltraLite EVK	fsl-image-gui-x11-imx6ulevk.sdcard

Table 5: i.MX6 Bundle Download Links and Specific SD Card Image Filenames

6.4 Flashing SD Card

Insert SD card into host machine (PC). The SD card must get enumerated as "/dev/sdx" device (may require SD card to USB adapter). Once SD card has been inserted, run "dmesg" command to find which "/dev/sdx" device just enumerated.

NOTE: Before running next command, make sure you have selected correct device. Otherwise you can wipe your hard drive!

$ sudo dd if=<fsl image name>.sdcard of=/dev/sdx bs=1M && sync

6.5 Copying/Replacing/Modifying Files on SD Card

You will have already downloaded two packages from Section **6.2**. Now we have to copy these files over to newly prepared SD card. First let's take care of Freescale binary download (contains zImage, new dtb files, and bcmdhd.ko driver file).

$ tar –xvf L3.14.38_6ul-ga_binaries_11072015.tar
$ cd L3.14.38_6ul-ga_binaries_11072015

For non-UltraLite platforms, we copy over the modified kernel:
$ sudo cp zImage <i.MX6 Target Boot folder>

For all platforms, we need to copy over the modified DTB files:
$ sudo cp *.dtb <i.MX6 Target Boot folder>

Next two steps are optional. If already using L3.14.38 rootfs, then we don't have to copy "bcmdhd.ko". For previous L3.14.28 rootfs, perform next two steps:

$ sudo mkdir <i.MX6 rootfs>/lib/modules/3.14.xx.yy/kernel/drivers/net/wireless/bcmdhd
$ sudo cp bcmdhd.ko <i.MX6 rootfs>/lib/modules/3.14.xx.yy/kernel/drivers/net/wireless/bcmdhd/

To better understand the new Device Tree Blob (dtb) files, please refer to **Table 6**. The target i.MX6 device is listed along with options of dts/dtb files. DTS files are located at "/arch/arm/boot/dts". DTB files are very useful when it comes to re-configuring hardware. When booting the platform, customer merely has to select the correct DTB file by using "setenv fdt_file" command at u-boot prompt.

Target (MACHINE)	Default	Optional
imx6dlsabresd	imx6dl-sabresd-murata-v2.dtb	imx6dl-sabresd-murata-v1_sdext.dtb
imx6qsabresd	imx6q-sabresd-murata-v2.dtb	imx6q-sabresd-murata-v1_sdext.dtb
imx6slevk	imx6sl-evk-murata-v1_sdext.dtb	N/A
imx6sxsabresd	imx6sx-sdb-murata-v1_sdext.dtb	imx6sx-sdb-murata-v2.dtb
imx6ulevk	imx6ul-14x14-evk-murata-v2.dtb	N/A

Table 6: i.MX6 Targets supported on Linux 3.14.38 GA Release

Next let's take care of the [Broadcom firmware drop](). This step is just a simple copy.

$ sudo cp BRCM_FW_for_i.MX_11072015.tar <i.MX6 rootfs>/home/root/

To prevent Broadcom WLAN (bcmdhd) driver being loaded during kernel boot, it must be added to "blacklist" configuration file. In the command below, "gedit" is used to edit the "blacklist.conf" file:

$ sudo gedit <i.MX6 rootfs>/etc/modprobe.d/blacklist.conf
   ⇨ add line: "blacklist bcmdhd"; save file

Now the SD card is ready. Make sure all changes are saved correctly (i.e. "sync" command or "safely remove drive", etc.) and plug it into the Freescale i.MX6 Platform.

7   Test/Verification of Wi-Fi and Bluetooth

Now the kernel should be booting correctly on the platform with Murata Wi-Fi/BT EVK pugged in (i.e. already set correct DTB file when interrupting u-boot). Next steps are to quickly verify that Wi-Fi and Bluetooth are functional.

Before testing either Wi-Fi or Bluetooth, there is one necessary step (first boot only on "fresh" SD card) to install the necessary firmware, NVRAM, and tool files. Once kernel has booted, you should see the Broadcom firmware package in the root home folder. First extract it (using "tar" command) and then run Murata shell script to install necessary files.

Login: root
$ ls
BRCM_FW_for_i.MX_11072015.tar
$ tar -xvf BRCM_FW_for_i.MX_11072015.tar
$ cd BRCM_FW_for_i.MX_11072015
$ . ./Murata_Startup_Script.sh

Expected output is (need to enter current Murata module being tested and hit return):

Please enter EVB String (ZP, 1BW, 1DX, or SN8000): 1DX
Selecting Murata Type 1DX...

The Murata script file does the following:

1) Copies Bluetooth firmware "patch files" to "/etc/firmware" folder.
2) Copies Wi-Fi folders (ZP/1BW/1DX/SN8000) to "/lib/firmware/bcm" folder. Each of these folders contains firmware and NVRAM specific to each module.
3) Copies "WL" tool to "/bin" folder. This is a Broadcom-specific WLAN configuration/test utility.
4) Copies firmware and NVRAM for selected module to "/lib/firmware/bcm" folder. This script file defaults to copying over NVRAM for SDIO in-band interrupt signaling.
5) If user enters wrong module string then the script will exit with a warning statement.

7.1   Bringing up Wi-Fi for Quick Test/Verification

To bring up Wi-Fi, a script file is included to make things easier. Invoke as follows:

$ . ./insmod_Wi-Fi-Driver.sh

Some of the key parameters:
- "firmware_path" provides entire path and filename to firmware being loaded.
- "nvram_path" provides entire path and filename to NVRAM being loaded.
- "dhd_msg_level" sets debug output. Defaults to 0x1 (error only). For full logs, set this to 0xffff.

   NOTE: "insmod_Wi-Fi-Driver.sh" script may require editing so that correct path is used for "bcmdhd.ko" file. Path for 3.14.38 kernel is default. Path for 3.14.28 is commented out.

Expected Output Is:

dhd_module_init in
Power-up adapter 'DHD generic adapter'
wifi_platform_bus_enumerate device present 1
F1 signature OK, socitype:0x1 chip:0xa9a6 rev:0x1 pkg:0x3
DHD: dongle ram size is set to 524288(orig 524288) at 0x0
wifi_platform_get_mac_addr
CFG80211-ERROR) wl_setup_wiphy : Registering Vendor80211)
wl_create_event_handler(): thread:wl_event_handler:3a8 started
CFG80211-ERROR) wl_event_handler : tsk Enter, tsk = 0xa9dc141c
dhd_attach(): thread:dhd_watchdog_thread:3a9 started
dhd_attach(): thread:dhd_dpc:3aa started
dhd_deferred_work_init: work queue initialized
dhdsdio_write_vars: Download, Upload and compare of NVRAM succeeded.
dhd_bus_init: enable 0x06, ready 0x06 (waited 0us)
wifi_platform_get_mac_addr
Firmware up: op_mode=0x0005, MAC=fc:db:b3:80:eb:81
Firmware version = wl0: Dec 11 2014 04:20:45 version 7.10.323.34 (r520360) FWID 01-ea2beeba
dhd_wlfc_init(): successfully enabled bdcv2 tlv signaling, 79
dhd_wlfc_init: query wlfc_mode succeed, fw_caps=0x1c
dhd_wlfc_init(): wlfc_mode=0x1c, ret=0

Dongle Host Driver, version 1.141.72 (r)
Compiled from
Register interface [wlan0] MAC: fc:db:b3:80:eb:81

You can ignore the "CFG80211-ERROR" messages. Key line is the last one indicating that "wlan0" interface is active. Now invoke "ifconfig" command to bring up "wlan0". "WL" can be invoked to actively scan the environment. The "scanresults" will return any visible SSID's.

$ ifconfig wlan0 192.168.1.111 up   /* Other IP Address (or none) can be selected here. */
$ wl scan
$ sleep 2   /* Delay inserted for Wi-Fi to obtain probe responses; increases for dual-band. */
$ wl scanresults

> **NOTE: "CFG80211-ERROR) wl_notify_scan_status : scan is not ready" message is to be expected. The delay in command sequence is necessary. Otherwise "wl scanresults" returns nothing. Only once "CFG80211-ERROR" message is logged to console, can "wl scanresults" be invoked.**

<u>Expected Output Is:</u>

$ ifconfig wlan0 192.168.1.111 up
$ wl scan
"CFG80211-ERROR) wl_notify_scan_status : scan is not ready

$ wl scanresults
SSID: "Murata-WS-416F82"
Mode: Managed   RSSI: -68 dBm   SNR: 0 dB   noise: 0 dBm   Flags: RSSI on-channel Channel: 1
BSSID: 00:0B:6C:41:6F:82   Capability: ESS ShortSlot
Supported Rates: [1(b) 2(b) 5.5(b) 6 9 11(b) 12 18 24 36 48 54]
HT Capable:
        Chanspec: 2.4GHz channel 1 20MHz (0x1001)
        Primary channel: 1
        HT Capabilities:
        Supported MCS : [0 1 2 3 4 5 6 7]

SSID: "MY_AP_SSID"
Mode: Managed   RSSI: -61 dBm   SNR: 0 dB   noise: 0 dBm   Flags: RSSI on-channel Channel: 1
BSSID: 00:18:E7:FE:5C:13   Capability: ESS WEP ShortPre ShortSlot
Supported Rates: [1(b) 2(b) 5.5(b) 6(b) 9 11(b) 12(b) 18 24(b) 36 48 54]
WPA:
        multicast cipher: TKIP
        unicast ciphers(2): AES-CCMP TKIP
        AKM Suites(1): WPA-PSK
        No WPA Capabilities advertised
RSN:
        multicast cipher: TKIP
        unicast ciphers(2): AES-CCMP TKIP
        AKM Suites(1): WPA-PSK
        Capabilities(0x0000): No Pre-Auth, Pairwise, 1 PTK Replay Ctr1 GTK Replay Ctr
HT Capable:
        Chanspec: 2.4GHz channel 1 20MHz (0x1001)

…… etc.

7.2 Bringing up Bluetooth for Quick Test/Verification

For Murata modules supporting Bluetooth, we can verify the HCI UART connection by invoking "hciattach", bringing up the interface with "hciconfig" and then invoking "hcitool scan" to see what Bluetooth devices are visible. The Bluetooth test commands vary depending on interconnect: which GPIO toggles the BT_REG_ON signal, and the UART port connection. It is necessary to reset the Bluetooth core before trying to initialize it (i.e. download Bluetooth "patch file" firmware – located in "/etc/firmare" folder). See **Table 7** below: hyperlinks to platform-specific subsections are provided so user can copy/paste/invoke entire command sequence from the console.

i.MX6	Default	Optional	Notes
i.MX 6Quad/DualLite SABRE-SD	GPIO2; UART5 (V2)	N/A (V1)	Only V2 Adapter connection provides BT connectivity.
i.MX 6SoloX SABRE-SD	GPIO171; UART3 (V1)	GPIO106; UART5 (V2)	Both V1/V2 Adapters provide BT connectivity on SoloX.
i.MX 6SoloLite EVK	GPIO145; UART4 (V1)	N/A	
i.MX 6UltraLite EVK	GPIO252; UART2 (V2)	N/A	GPIO252 does not allow its direction to be set. Always output.

Table 7: GPIO and UART Settings for Bluetooth Tests

When controlling the "GPIO register/BT_REG_ON signal", we drive BT_REG_ON low (resets BT core) and then drive it high again (takes BT core out of reset). Test command sequence is as follows:

echo [GPIO #] > /sys/class/gpio/export
echo out > /sys/class/gpio/gpio[GPIO #]/direction   /* SKIP this step for i.MX 6UltraLite EVK */
echo 0 > /sys/class/gpio/gpio[GPIO #]/value
sleep 0.1
echo 1 > /sys/class/gpio/gpio[GPIO#]/value
hciattach /dev/ttymxc[UART# -1] bcm43xx 3000000 flow -t 20
hciconfig hci0 up
hcitool scan

To clarify the syntax, here is the command sequence for i.MX 6Quad SABRE-SD with V2 Adapter (sequence sets UART rate to 3Mbaud - default rate for Broadcom chipset):

echo 2 > /sys/class/gpio/export
echo out > /sys/class/gpio/gpio2/direction
echo 0 > /sys/class/gpio/gpio2/value
sleep 0.1
echo 1 > /sys/class/gpio/gpio2/value
hciattach /dev/ttymxc4 bcm43xx 3000000 flow -t 20
hciconfig hci0 up
hcitool scan

Here is example output with Type ZP module (not including GPIO setup):

```
$ hciattach /dev/ttymxc4 bcm43xx 3000000 flow -t 20
bcm43xx_init
Set Controller UART speed to 3000000 bit/s
Flash firmware /etc/firmware/BCM4335C0.ZP.hcd
Set Controller UART speed to 3000000 bit/s
Device setup complete
$ hciconfig hci0 up
$ hcitool scan
Scanning ...
    60:D8:19:B3:7F:41    DMNTNGR-X220
    78:F7:BE:72:07:E6    SDK's GS4
```

7.2.1 i.MX 6Quad/DualLite SABRE-SD (Default: V2 Adapter)

```
echo 2 > /sys/class/gpio/export
echo out > /sys/class/gpio/gpio2/direction
echo 0 > /sys/class/gpio/gpio2/value
sleep 0.1
echo 1 > /sys/class/gpio/gpio2/value
hciattach /dev/ttymxc4 bcm43xx 3000000 flow -t 20
hciconfig hci0 up
hcitool scan
```

7.2.2 i.MX 6SoloX SABRE-SD (Default: V1 Adapter)

```
echo 171 > /sys/class/gpio/export
echo out > /sys/class/gpio/gpio171/direction
echo 0 > /sys/class/gpio/gpio171/value
sleep 0.1
echo 1 > /sys/class/gpio/gpio171/value
hciattach /dev/ttymxc2 bcm43xx 3000000 flow -t 20
hciconfig hci0 up
hcitool scan
```

7.2.3 i.MX 6SoloX SABRE-SD (Optional: V2 Adapter)

```
echo 106 > /sys/class/gpio/export
echo out > /sys/class/gpio/gpio106/direction
echo 0 > /sys/class/gpio/gpio106/value
sleep 0.1
echo 1 > /sys/class/gpio/gpio106/value
hciattach /dev/ttymxc4 bcm43xx 3000000 flow -t 20
hciconfig hci0 up
hcitool scan
```

7.2.4   i.MX 6SoloLite EVK (Default: V1 Adapter)

```
echo 145 > /sys/class/gpio/export
echo out > /sys/class/gpio/gpio145/direction
echo 0 > /sys/class/gpio/gpio145/value
sleep 0.1
echo 1 > /sys/class/gpio/gpio145/value
hciattach /dev/ttymxc3 bcm43xx 3000000 flow -t 20
hciconfig hci0 up
hcitool scan
```

7.2.5   i.MX 6UltraLite EVK (Default: V2 Adapter)

```
echo 252 > /sys/class/gpio/export
echo out > /sys/class/gpio/gpio252/direction
echo 0 > /sys/class/gpio/gpio252/value
sleep 0.1
echo 1 > /sys/class/gpio/gpio252/value
hciattach /dev/ttymxc1 bcm43xx 3000000 flow -t 20
hciconfig hci0 up
hcitool scan
```

8   Verifying Adapter Boards

To ensure correct functioning of Murata Wi-Fi/BT EVK, it is of key importance to check the adapter configuration based upon jumper settings and short pads open/closed.

8.1   Murata i.MX InterConnect V1 Adapter
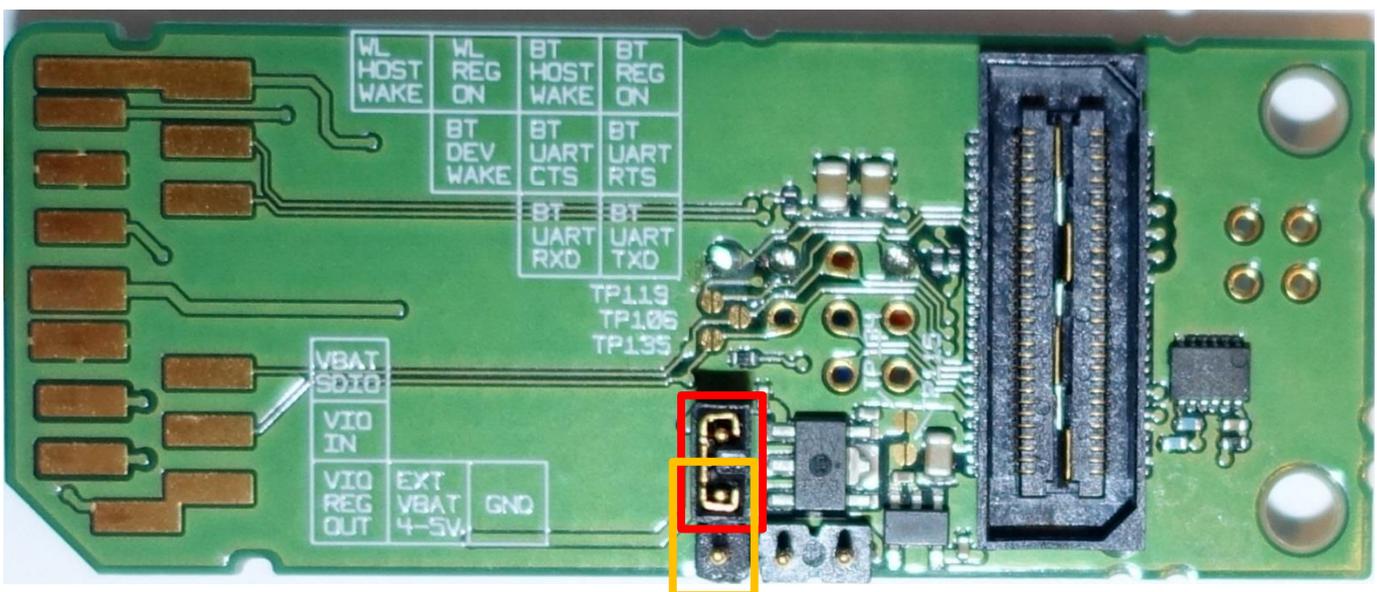
Figure 8: Murata i.MX InterConnect V1 Adapter - Top

Refer to **Figure 8**: **Murata i.MX InterConnect V1 Adapter - Top** for default configuration on V1 Adapter board. VIO jumper should be in **RED** position – set for VBAT_SDIO which is approximately 3.3V (i.e. VIO = VBAT). The adapter allows for 1.8V VIO operation (ORANGE position) but this Quick Start Guide currently does not support that option. A future revision will support both 1.8V and 3.3V VIO signaling on platforms/configurations that permit it. Note that there are **no closed** (soldered) short-pads on V1 Adapter from top view. Of course you will see the soldered connections for WL_HOST_WAKE, WL_REG_ON, and BT_REG_ON.
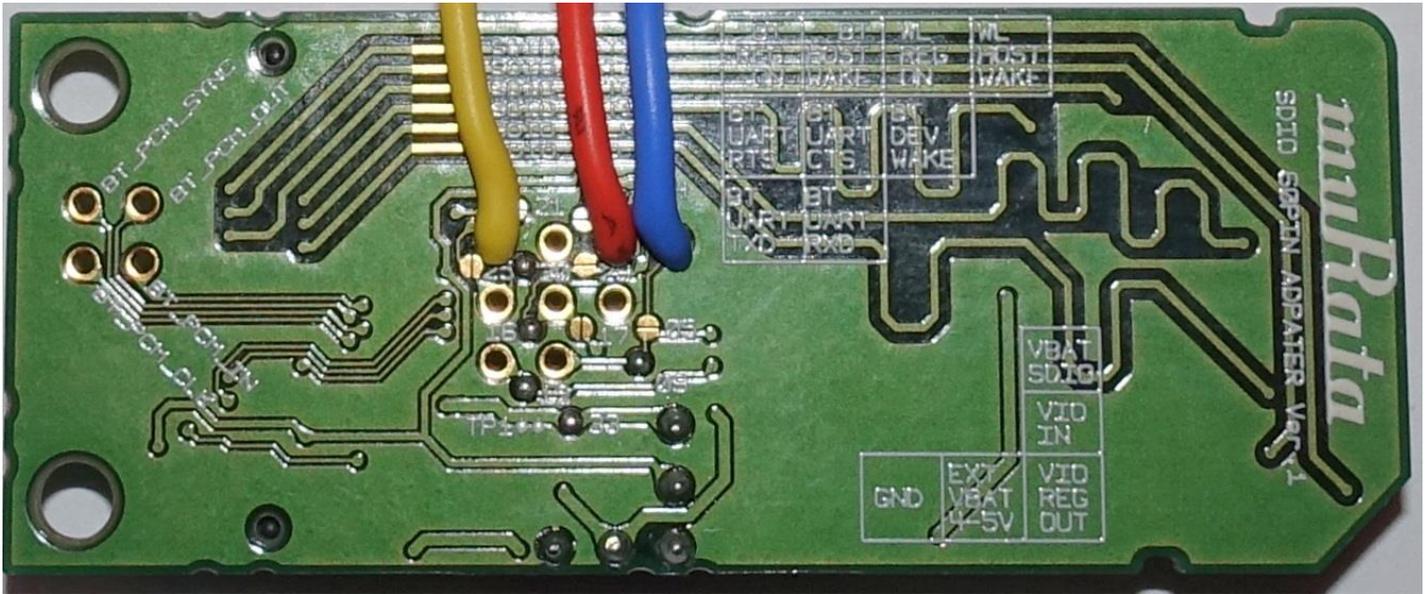
Figure 9: Murata i.MX InterConnect V1 Adapter – Bottom #1
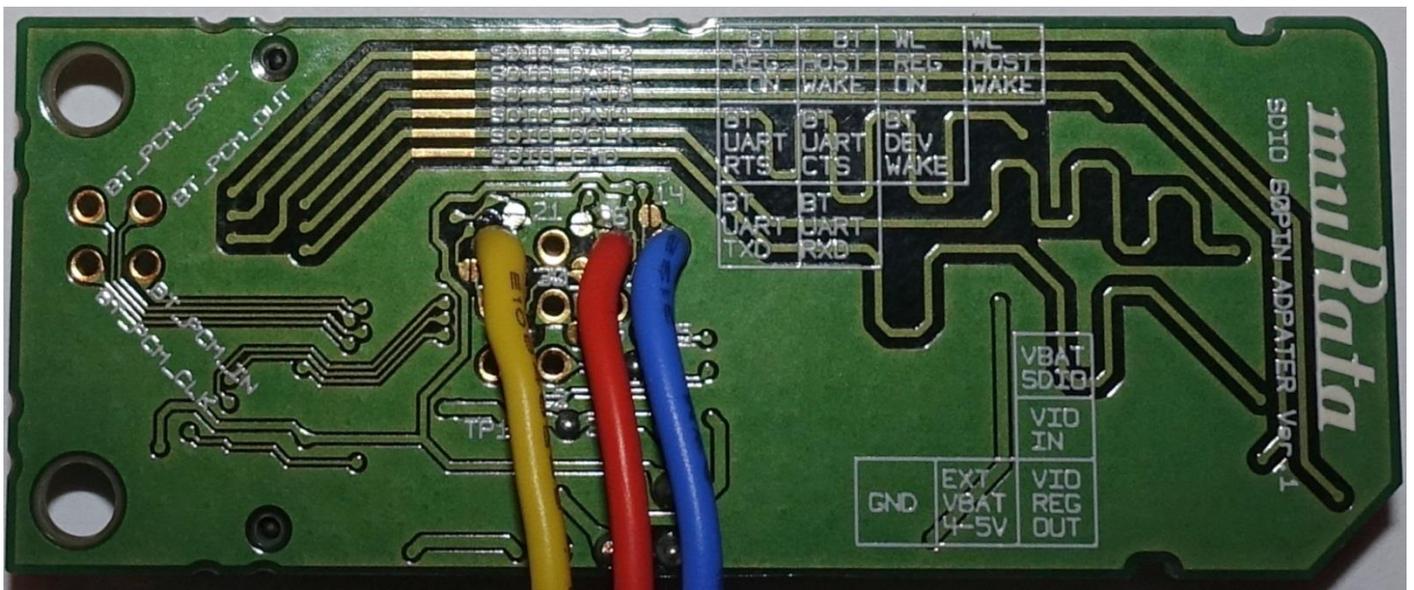
Figure 10: Murata i.MX InterConnect V1 Adapter – Bottom #2

Two figures are presented for the bottom side of the Murata i.MX InterConnect V1 Adapter. This is done to give unobstructed views of all the short pads. Refer to **Figure 9: Murata i.MX InterConnect V1 Adapter – Bottom #1** and **Figure 10: Murata i.MX InterConnect V1 Adapter – Bottom #2** for

default configuration on V1 Adapter Board. Compare your adapter with the short pads (open versus closed). There should be a one-to-one mapping. The short pad selections on bottom of adapter board connect Bluetooth UART through to SD_DAT4..7 pins (TP109, TP122, TP116, and TP130 closed/soldered). TP133 short pad is closed/soldered to connect VBAT_SDIO (voltage supply from SD VDD Pin #4) to VBAT_IN which powers the Murata Wi-Fi/BT EVB. The other power supply option is to use an external power supply: short TP134 (with TP133 open) and connect external supply to TP131 and TP132 (marked "EXT VBAT 4-5V" and "GND" on silkscreen - see **Figure 8**).

The V1 Adapter is pre-wired to SD Card Extender. This is done to provide "plug 'n play" interoperability with Freescale i.MX 6SoloX SABRE-SD and i.MX 6SoloLite EVK. The connected signals are BT_REG_ON (yellow), WL_REG_ON (orange), and WL_HOST_WAKE (blue). This allows direct mapping to i.MX6 GPIO's to these control signals. For additional specific information on default configuration, please reference the [Hardware User Manual.](#)

8.2 Murata i.MX InterConnect V2 Adapter

To ensure correct functioning of Murata Wi-Fi/BT EVK, it is of key importance to check the adapter configuration based upon jumper settings and short pads open/closed. V2 Adapter is much simpler than V1. However it is still important to check all connections to make sure they match defaults.

Refer to **Figure 11**: **Murata i.MX InterConnect Adapter V2 Adapter - Top**. VIO jumper should be in **RED** position – set for VBAT_SDIO which is approximately 3.3V (i.e. VIO = VBAT). The adapter allows for 1.8V VIO operation (**ORANGE** position) but this Quick Start Guide currently does not support that option. A future revision will support both 1.8V and 3.3V VIO signaling on platforms/configurations that permit it. Only two short pads are close on top: TP14 and TP13. TP14 short pad is closed/soldered to connect VBAT_SDIO (voltage supply from SD VDD Pin #4) to VBAT_IN which powers the Murata Wi-Fi/BT EVB. The other power supply option is to use an external power supply: short TP15 (with TP14 open) and connect external supply to TP11 and TP12 (marked "Ext/VBAT4-5V" and "GND" on silkscreen - see **Figure 11**). TP13 connects the BT_REG_ON control signal.
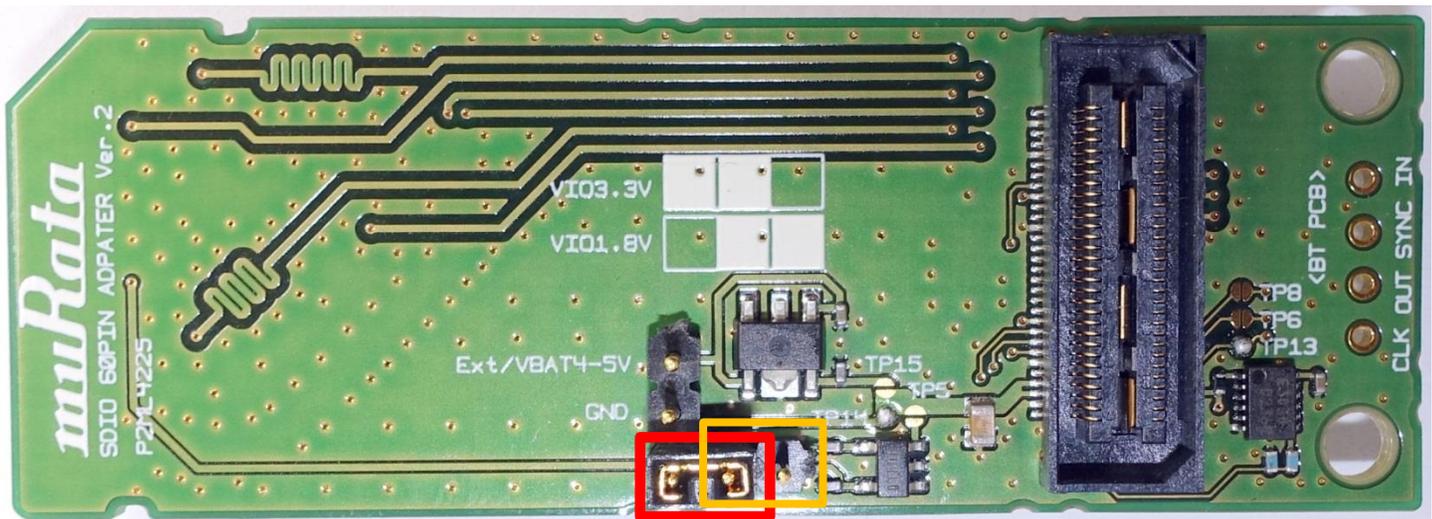
Figure 11: Murata i.MX InterConnect Adapter V2 Adapter - Top

Refer to **Figure 12**: **Murata i.MX InterConnect Adapter V2 Adapter - Bottom**. Both TP20 and TP21 short pads are closed to connect WL_REG_ON and WL_HOST_WAKE respectively. WL_HOST_WAKE is an optional out-of-band interrupt signal that is not defined in this Quick Start document. It will be documented (and optionally enabled) in future version.
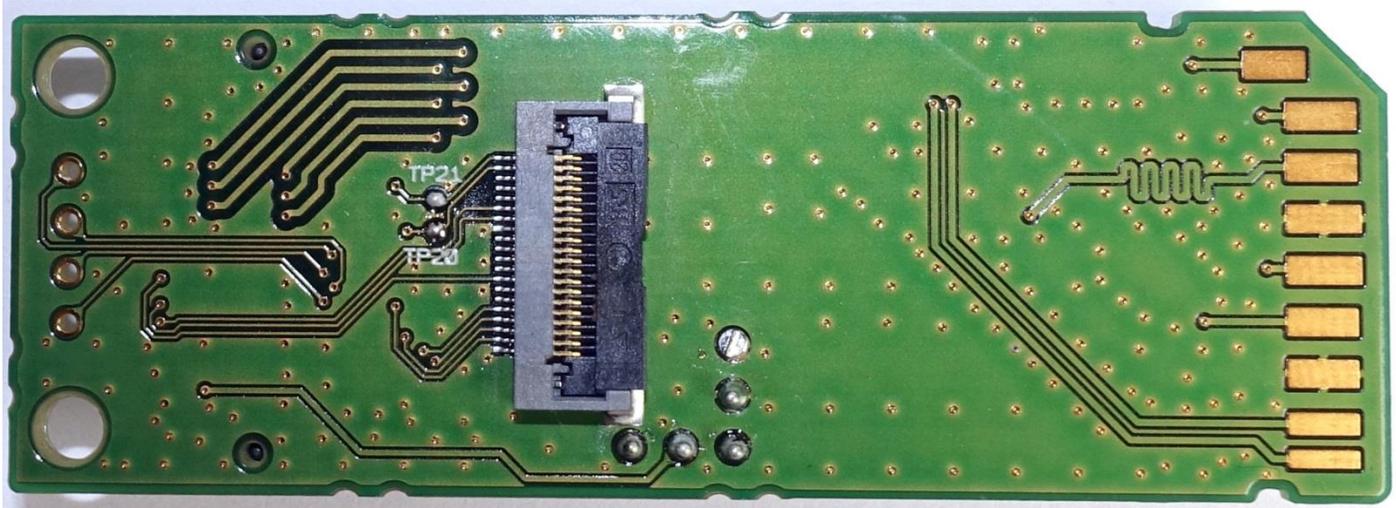
Figure 12: Murata i.MX InterConnect Adapter V2 Adapter - Bottom

For additional specific information on default configuration, please reference the Hardware User Manual.

9 Technical Support Contact

Contact Wireless module application support at imxfaq@murata.com